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Tsunekawa et al.

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(54) **SUSPENSION DEVICE FOR A VEHICLE**

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B60G 15/06 (2006.01)
F16F 9/38 (2006.01)

(52) **U.S. Cl.**
CPC ***B60G 11/14*** (2013.01); ***B60G 15/062*** (2013.01); ***F16F 9/38*** (2013.01); *B60G 2202/12* (2013.01); *B60G 2204/4308* (2013.01)

(58) **Field of Classification Search**
CPC B60G 99/00; B60G 3/01; B60G 11/14; B60G 2202/12; B60G 2204/4308
See application file for complete search history.

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(57) **ABSTRACT**

1. Objective:
Endurance of a dust cover **50** mounted on a suspension device wherein a top spring seat **85** is formed to be inclined to an axis of a shock absorber **10** and disposed rotatably about a top seat axis inclined to an axis of a shock absorber **10** is improved.
2. Means for Solution:
The suspension device comprises a rotation prevention portion **100** so that the dust cover **50** cannot rotate relatively a top seat portion **90** about an axis of the top seat portion **90**. The rotation prevention portion **100** comprises two convex portions **110** formed in the top seat portion **90** and two concave portions **120** formed in a top connecting portion **60** of the dust cover **50**.

1 Claim, 5 Drawing Sheets

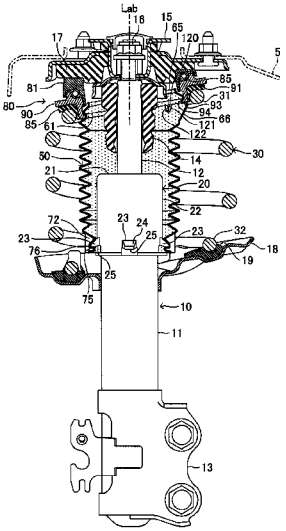

FIG. 1

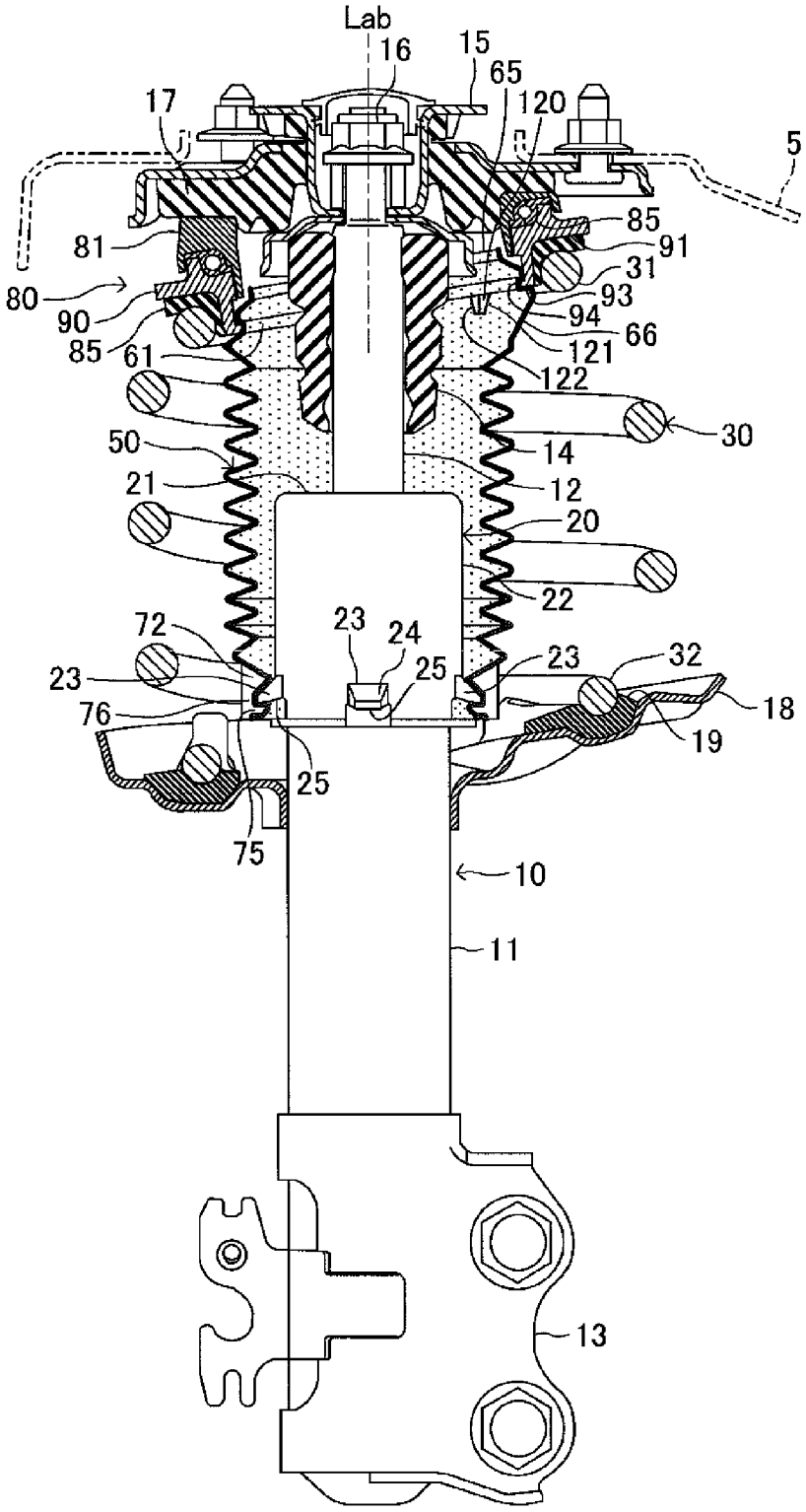
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FIG. 2

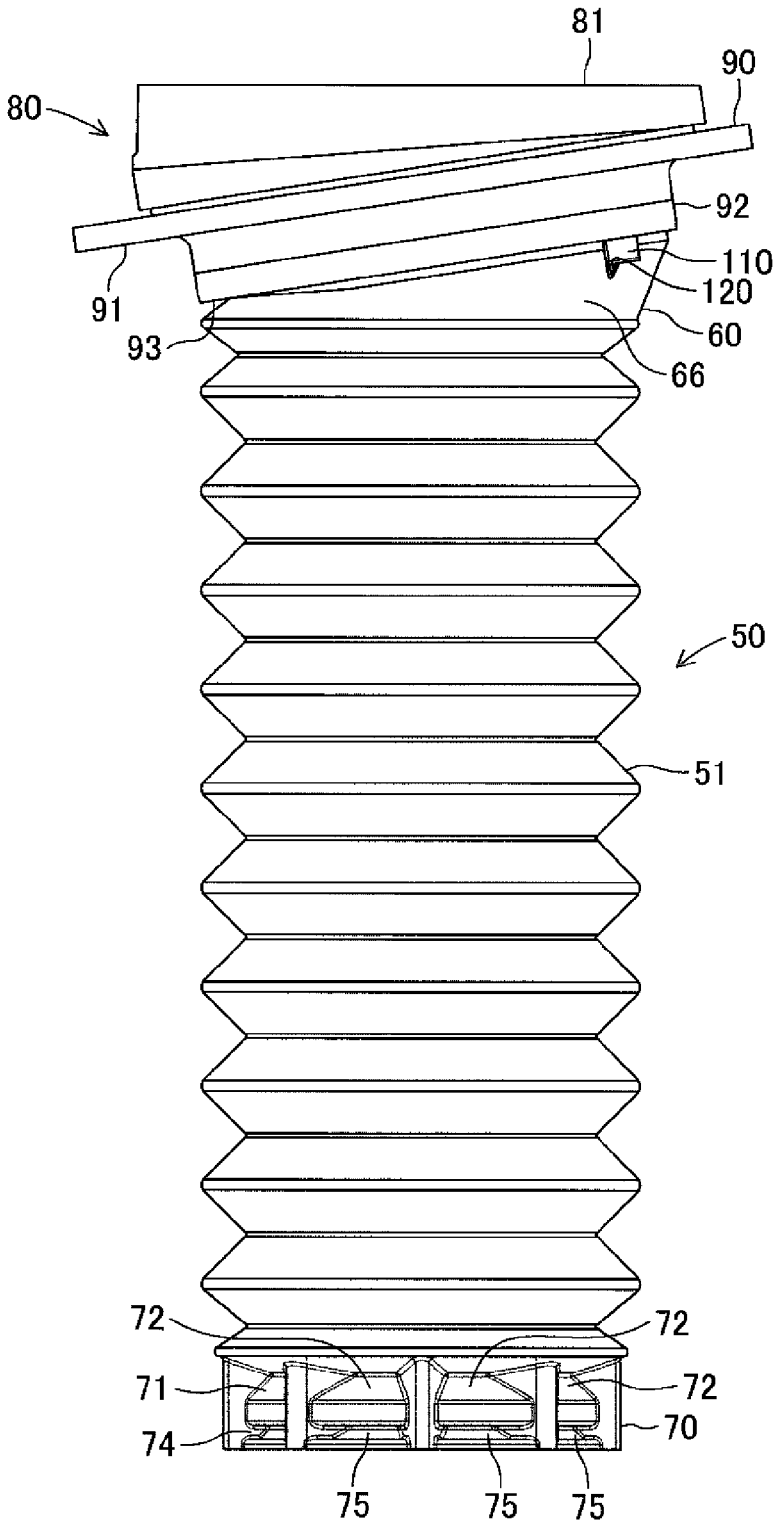
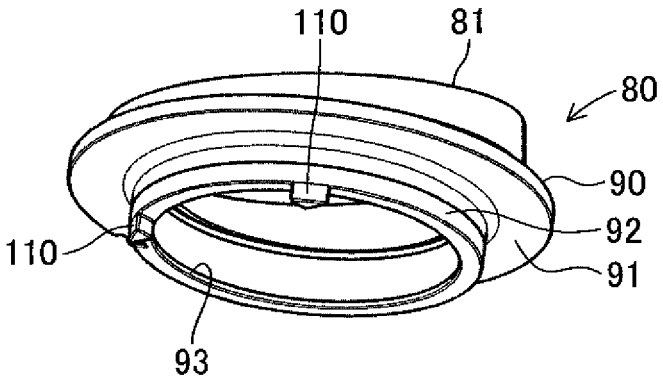


FIG. 3


110
81
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90
92
91
110
93

FIG. 4

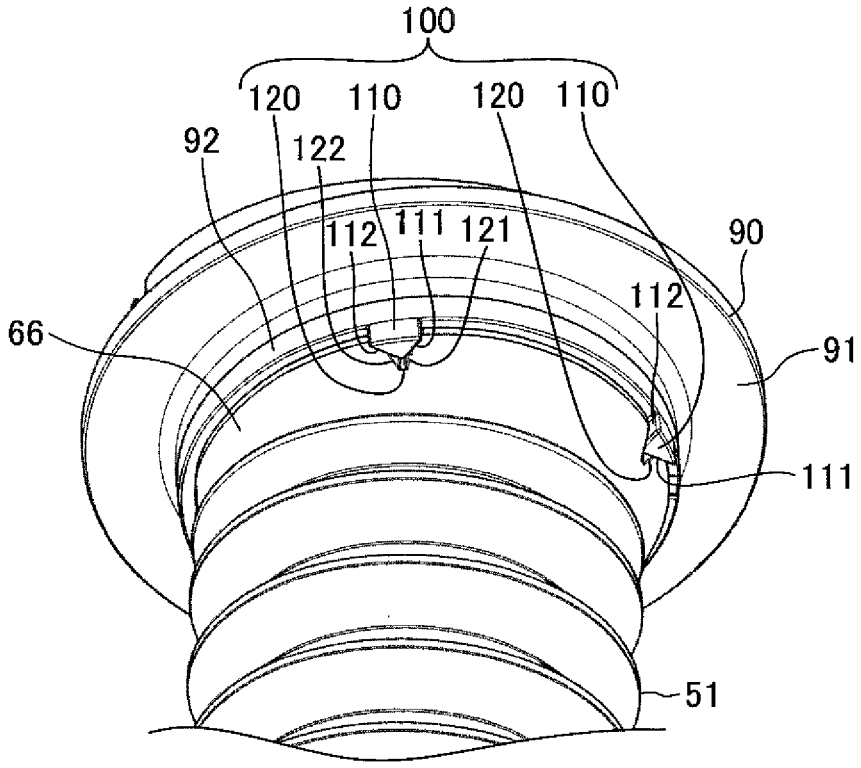

100
120
110
120
110
92
122
112
111
121
90
112
66
91
111
51

FIG 5

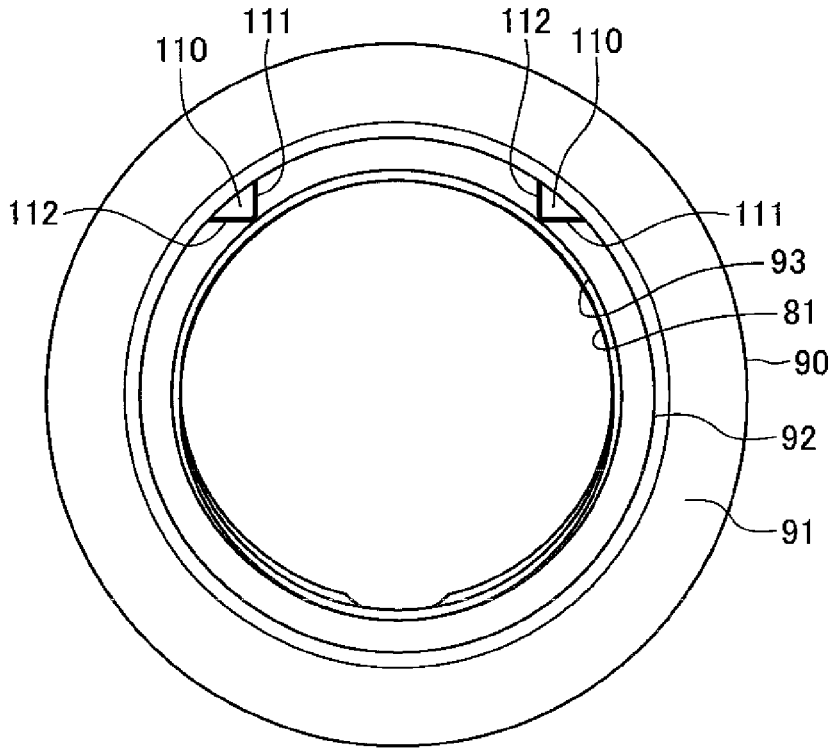


FIG 6

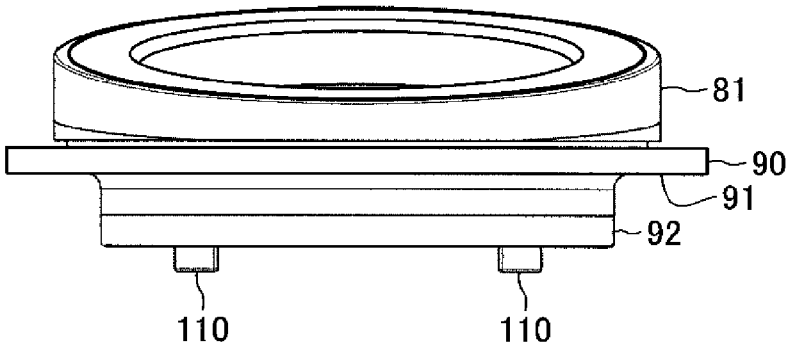
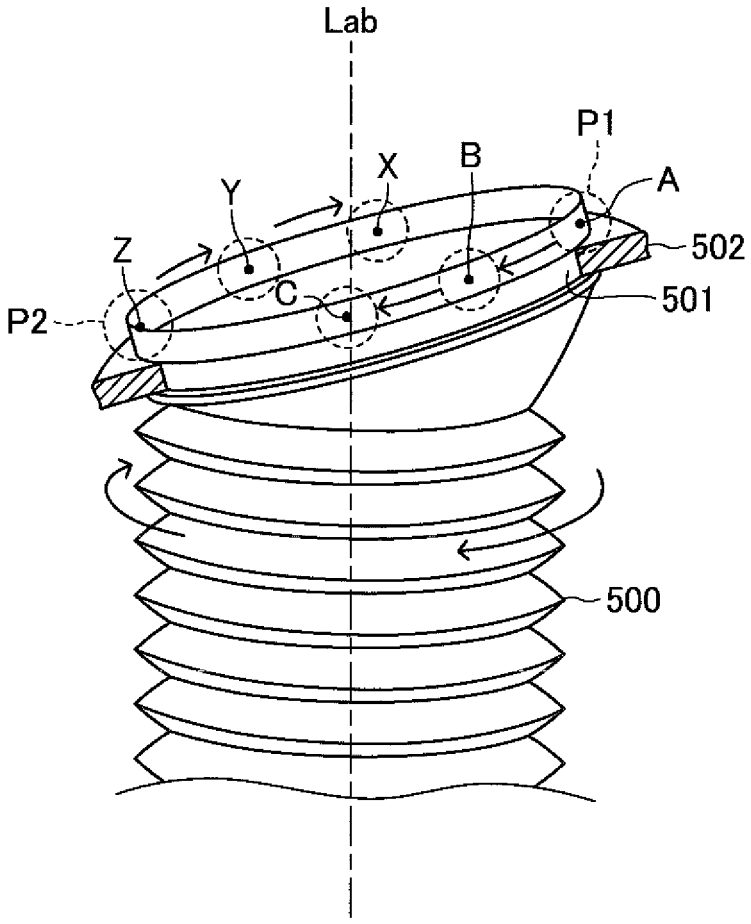


FIG. 7



SUSPENSION DEVICE FOR A VEHICLE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a suspension device for a vehicle, especially to a mounting structure of a dust cover which covers the surroundings of a shock absorber.

2. Description of the Related Art

For instance, a strut-type suspension comprises a shock absorber disposed between a wheel and a vehicle body, and a coil spring wound on the outer periphery side of this shock absorber. The coil spring is mounted between a top spring seat disposed on the side of a structure which supports the vehicle body and a bottom spring seat disposed on the cylinder sheath side of the shock absorber, for example. Moreover, in order to protect the oil seal of the shock absorber from foreign matters, such as sand, a dust cover is disposed between the shock absorber and the coil spring. As for the dust cover disclosed in the patent document 1, its top end is fixed to the top spring seat and its bottom end is fixed to the bottom spring seat.

CITATION LIST

Patent Literature

[Patent Document 1] Japanese Patent Application Laid-Open (kokai) No. 57-129942

SUMMARY OF THE INVENTION

In a suspension disposed on a steered wheel, a top spring seat can rotate about the axis of a shock absorber. For this reason, a dust cover needs to be attached so that it may not interfere with a relative rotation of the top spring seat and the bottom spring seat, and so that a dust cover may not be deformed by the above-mentioned relative rotation. In this case, in order to make it easy to mount a dust cover, for example, a configuration wherein the top end of a dust cover is rotatably fitted into an inner circumference portion of a top spring seat and the bottom end of the dust cover is rotatably fitted into a cylinder side member (the bottom spring seat may be sufficient) fixed to the cylinder sheath side can be employed.

However, when a top spring seat is disposed to be inclined to the axis of a shock absorber, the following issues will arise.

When a shock absorber expands and contracts, a coil spring also expands and contracts accordingly. When the coil spring makes this expansion and contraction movement, the winding seat portions on an upper end side and a lower end side of the coil spring make a repetitive rotational movement about a coil axis relatively. The winding seat portions on the upper end side and lower end side of the coil spring are respectively fixed to a top spring seat and a bottom spring seat through an insulator so that they may not slide over the spring seats. Therefore, when the coil spring makes an expansion and contraction movement, a top spring seat is made to repetitively rotate about the axis in connection therewith.

In a configuration wherein an upper end of a dust cover is rotatably fitted into an inner circumference portion of the top spring seat, the dust cover also repetitively rotate in association with the top spring seat by the friction in a fitting portion. When the expansion and contraction movement of the coil spring finishes, the top spring seat will certainly

return to an initial rotational position according to the restoring force of the coil spring. On the other hand, the dust cover repetitively rotates while sliding over the fitting portions on its upper end and lower end during the expansion and contraction movement of the coil spring. Furthermore, since the extent of a friction at the fitting portion when rotating in one direction is not necessarily completely the same as that when rotating in the other direction, the amount of slide in one rotational direction may be larger or smaller than the amount of slide in the other rotational direction. As a result, the position of the dust cover with respect to the top spring seat rotationally shifts from its initial position to one direction or the other little by little whenever the expansion and contraction movement of the coil spring is performed.

The shift of the rotational position of the dust cover is be perfectly acceptable when the top spring seat is disposed to perpendicularly intersect with the axis of the shock absorber. However, as shown in FIG. **7**, in a configuration wherein a top spring seat **502** is prepared to be inclined to an axis Lab of a shock absorber, an upper end fitting portion **501** of the dust cover **500** is also disposed to be inclined to a plane perpendicular to the axis Lab of the shock absorber. For this reason, when the dust cover **500** rotates relatively to the top spring seat **502** as mentioned above, a portion P**1** which should be located at the uppermost position in the upper end fitting portion **501** of the dust cover **500** gradually shifts from A point which is a proper location to B point, and further to C point. At the same time, a portion P**2** which should be located at the lowermost position in the upper end fitting portion **501** of the dust cover **500** gradually shifts from Z point which is a proper location to Y point, and further to X point.

In association with this position shift, load acts in a direction in which the coil spring expands on the P**1** side (region extending to the axial direction from P**1**), while it acts in a direction in which the coil spring contracts on the P**2** side (region extending to the axial direction from P**2**) in the dust cover **500**. For this reason, the load acting on the dust cover **500** becomes uneven along a circumferential direction, and a strain arises in the dust cover **500**. When the shock absorber expands and contracts (a coil spring expands and contracts) by a vertical vibration of a vehicle body in this status, the dust cover **500** will be expanded and contracted more than expected in its design, and its endurance will fall.

The present invention has been made in order to cope with the above-mentioned problem, and one of its objectives is to improve the endurance of a dust cover.

In order to attain the above-mentioned objective, an aspect of the present invention is a suspension device for a vehicle comprising:

a shock absorber (**10**) disposed between a wheel and a vehicle body,

a coil spring (**30**) disposed between a top spring seat (**90**) in a shape of a ring and a bottom spring seat (**18**) in a shape of a ring, said top spring seat (**90**) is disposed on the side of a structure (**15**, **17**, **81**) which supports said vehicle body and said bottom spring seat (**18**) is disposed on a cylinder sheath (**11**) side of said shock absorber, and

a dust cover (**50**) disposed between said shock absorber and said coil spring, said dust cover is elastically deformable and is in a shape of bellows tube,

wherein:

said top spring seat (**90**) is formed so that a supporting surface which supports an upper end of said coil spring through an insulator is inclined to an axis of said shock

absorber and said top spring seat is disposed rotatably about a top seat axis inclined to said axis of said shock absorber,

a lower end (**70**) of said dust cover is attached to a sheath side member (**20**) rotatably about an axis of said shock absorber, by being fitted into said sheath side member fixed and disposed on said cylinder sheath side,

an upper end (**60**) of said dust cover is attached to said top spring seat by being fitted into a radially inner circumference portion of said top spring seat and comprises a cover side rotation prevention portion (**120**) forming cover side rotation prevention surfaces (**121**, **122**) which are surfaces enable to contact with said top spring seat in both rotational directions about said top seat axis so that said upper end of said dust cover does not relatively rotate about said top seat axis over said top spring seat in a status that said upper end of said dust cover is fitted into said radially inner circumference portion of said top spring seat, and

said top spring seat comprises a seat side rotation prevention portion (**110**) forming seat side rotation prevention surfaces (**111**, **112**) which are surfaces enable to contact with said cover side rotation prevention surfaces (**121**, **122**).

The suspension device for a vehicle according to the present invention is formed between a wheel and a vehicle body, and comprises a shock absorber, a coil spring and a dust cover. The coil spring is disposed between a top spring seat in a shape of a ring, which is disposed on the side of a structure supporting the vehicle body, and a bottom spring seat in a shape of a ring, which is disposed on a cylinder sheath side of the shock absorber. The coil spring supports a vehicle weight, and absorbs an impact. The shock absorber is disposed between the wheel and the vehicle body, and attenuates a vibration of the coil spring. The dust cover is formed in a shape of bellows tube, is disposed between the shock absorber and the coil spring, and protects an oil seal and/or a piston rod of the shock absorber from foreign matters, such as sand, for instance.

The top spring seat is formed so that a supporting surface which supports an upper end of the coil spring through an insulator is inclined to an axis of the shock absorber and is disposed rotatably about a top seat axis inclined to the axis of the shock absorber. Therefore, when a steering operation is performed, the top spring seat can be rotated accordingly.

A lower end of the dust cover is fitted into a sheath side member fixed and disposed on the cylinder sheath side and thereby attached to the sheath side member rotatably about an axis of the shock absorber. An upper end of the dust cover is fitted into a radially inner circumference portion of the top spring seat and thereby attached to the top spring seat. Therefore, the dust cover can be easily attached by fitting (an interdigitation).

For this reason, no special jointing member for holding the dust cover in a predetermined position is necessary. For instance, the upper end of the dust cover is formed so that it can be fitted into a radially inner circumference portion of the top spring seat along the circumferential direction by its own elastic deformation and restoration, by being pushed into the radially inner circumference portion of the top spring seat. Moreover, for example, the lower end of the dust cover is formed so that it can be fitted into the sheath side member along the circumferential direction by its own elastic deformation and restoration, by being pushed into the sheath side member.

When the upper end of the dust cover top is attached to the top spring seat and the lower end is attached to the sheath side member by such an interdigitation, the dust cover rotates together when the top spring seat rotates about the top seat axis (around a rotation axis of the top spring seat). The top spring seat repetitively rotates about the top seat axis in response to a force from a winding seat portion of the coil spring, whenever an expansion and contraction movement of the coil spring (expansion and contraction movement of the shock absorber) is made.

When the dust cover slides over the top spring seat at this time, the dust cover rotates in one direction or the other, and the position of the dust cover with respect to the top spring rotationally gradually shifts from its initial position. Since the top spring seat repetitively rotates about the top seat axis inclined to the axis of the shock absorber, load acting on the dust cover becomes uneven and a strain arises in the dust cover in association with the shift of the rotational position of the dust cover.

Therefore, in accordance with the present invention, the upper end of the dust cover comprises a cover side rotation prevention portion forming cover side rotation prevention surfaces which are surfaces enable to contact with the top spring seat in both rotational directions about the top seat axis so that the upper end of the dust cover does not relatively rotate about the top seat axis over the top spring seat in a status that the upper end of the dust cover is fitted into the radially inner circumference portion of the top spring seat. On the other hand, the top spring seat comprises a seat side rotation prevention portion forming seat side rotation prevention surfaces which are surfaces enable to contact with the cover side rotation prevention surfaces.

Therefore, the position of the dust cover with respect to the top spring seat does not shift by the contact of the cover side rotation prevention surfaces and the seat side rotation prevention surfaces. Thereby, since the dust cover can be maintained at a proper position, a trouble such as expansion and contraction of the dust cover in a status that the dust cover is distorted can be prevented. As a result, the endurance of the dust cover can be improved.

In addition, although the symbols used in an embodiment are assigned to the configuration of the invention corresponding to the embodiment in parenthesis in the above-mentioned illustration, in order to help understanding of the present invention, each constituent elements of the invention are not limited to the embodiment specified with the above-mentioned symbols.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic diagram of a suspension device for a vehicle according to the present embodiment.

FIG. **2** is a front elevation view for showing a status that a dust cover is fitted into a top spring seat unit.

FIG. **3** is a perspective view of a top spring seat unit.

FIG. **4** is a perspective view of a rotation prevention portion.

FIG. **5** is a top view of a top spring seat unit.

FIG. **6** is a front elevation view of a top spring seat unit.

FIG. **7** is a diagram for explaining a rotation of a dust cover.

DESCRIPTION OF THE INVENTION

Hereafter, a suspension device for a vehicle according to one embodiment of the present invention will be explained using drawings. FIG. **1** is a schematic diagram of a suspension device for a vehicle according to the present embodiment. The suspension device for a vehicle (hereafter, will be simply referred to as a suspension device) is a strut-type suspension device for suspending a front wheel which is a steered wheel from a vehicle body. The suspension device

comprises a shock absorber **10**, a coil spring **30** which is a suspension spring, and a dust cover **50**. In FIG. **1**, the dust cover **50** is displayed in gray (a dotted area) so that it may be easy to distinguish from other parts.

The shock absorber **10** comprises a cylinder **11** and a piston rod **12** having a piston (not shown), which moves back and forth in the cylinder **11**, at the end. A lower end of the cylinder **11** is fastened to a wheel side member (knuckle) which is not shown through a bracket **13**. A cylindrical bump stopper cap **20** is pressed downward and fixed at an upper end of the cylinder **11**.

The bump stopper cap **20** has a ring-like plate surface **21** facing a bound stopper **14** which will be mentioned later, at the top thereof. The bump stopper cap **20** is a member which supports the load of the bound stopper **14** on the ring-like plate surface **21** and restricts a stroke movement of the shock absorber **10**, when the shock absorber **10** makes a stroke movement to a predetermined position in a contraction direction.

In addition, in the present specification, directions such as upper and lower (top and bottom) represent directions in a status that the suspension device is properly disposed in the vehicle body **5**.

The bump stopper cap **20** is formed integrally with a protrusion **23** projecting outward in a radial direction from a circular-cylinder outer circumference surface **22**. As this protrusion **23**, a plurality of (for instance, four) protrusions **23** are formed at a predetermined interval along the circumferential direction on the lower side of the circular-cylinder contour surface **22** of the bump stopper cap **20**. Although will be mentioned later, this protrusion **23** is fitted into the lower end of the dust cover **50** and rotatably supports the lower end so that it may not escape in an up-and-down direction.

The upper end of the piston rod **12** is fastened to an upper support **15** with a nut **16**. The upper support **15** is fastened to the vehicle body **5**, and a cylindrical top spring seat unit **80** is formed in the back side. The top spring seat unit **80** comprises a base portion **81** non-rotatably fitted into the step portion of a back side member **17** of the upper support **15**, a ring-like top seat portion **90** which supports the coil spring **30** through the insulator **85**, and a strut bearing **85** which is disposed between the base portion **81** and the top seat portion **90** and supports the top seat portion **90** rotatably to the base portion **81**.

Although the base portion **81** is formed in a shape of an approximately circular cylinder as shown also in FIG. **2** and FIG. **3**, its height dimension (dimension in an axial direction) of the circular-cylinder wall is not constant in a circumferential direction and has a shape obtained by cutting the circular-cylinder wall aslant to its axis. Thereby, a ring-like plane surface **91** to which the insulator **85** in the top seat portion **90** tightly sticks forms a slope which has a predetermined tilt angle to a surface which intersects perpendicularly with the axis Lab of the shock absorber **10**. Therefore, a surface which intersects perpendicularly with a rotation axis of the top seat portion **90** intersects aslant to the axis Lab of the shock absorber **10**.

The top seat portion **90** is equivalent to the top spring seat according to the present invention, and a circular-cylinder wall **92** erected perpendicularly (with respect to the ring-like plane surface) from a radially inner end of the ring-like plane surface **91** is formed. At the end of the circular-cylinder wall **92**, a small-diameter step portion **93** which projects inward in a radial direction and has its inner diameter narrower than that of the circular-cylinder wall **92** is formed. The shape of the inner circumference portion of the small-diameter step portion **93** is formed circularly. This small-diameter step portion **93** retains the dust cover **50** rotatably about the axis in a status that the upper end of the dust cover **50** is fitted into the small-diameter step portion **93**.

In the upper portion of the piston rod **12**, the bound stopper **14** is fixed and disposed at a location surrounded by the inner circumference surface of the top spring seat unit **80**.

A bottom spring seat **18** in a shape of a ring is fixed to the outer circumference surface of the cylinder **11** by welding. The coil spring **30** is mounted in a status that it was compressed between the top seat portion **90** of the top spring seat unit **80** and the bottom spring seat **18**. The winding seat portion **31** (referred to as the upper winding seat portion **31**) on the side of the upper end of the coil spring **30** is supported by the top seat portion **90** through the insulator **85**, and the winding seat portion **32** (referred to as the lower winding seat portion **32**) on the side of the lower end of the coil spring **30** is supported by the bottom spring seat **18** through the insulator **19**.

Each of the insulators **19** and **85** is molded from a rubber material which has a predetermined hardness. The coil spring **30** is supported through the insulator **85** so that the upper winding seat portion **31** may not slide over the top seat portion **90** and it is supported through the insulator **19** so that the lower winding seat portion **32** may not slide over the bottom spring seat **18**.

The dust cover **50** covers an outer circumference (especially, the piston rod **12** and the portion in which the piston rod **12** moves back and forth from the cylinder **11**) of the shock absorber **10** in order to protect the oil seal and the piston rod **12** of the shock absorber **10** from foreign matters, such as sand, and it is disposed between the shock absorber **10** and the coil spring **30**. The dust cover **50** integrally comprises a bellows tube portion **51**, a top connecting portion **60** formed continuously from the upper end of the bellows tube portion **51**, and a bottom connecting portion **70** formed continuously from the lower end of the bellows tube portion **51**, as shown in FIG. **1** and FIG. **2**. The top connecting portion **60** is fitted into and connected with the small-diameter step portion **93** formed on the top seat portion **90** of the top spring seat unit **80**. Moreover, the bottom connection portion **70** is fitted into and connected with the protrusion **23** formed on the bump stopper cap **20**.

A depressed groove **61** which is concave inward in a radial direction and has a cross-section a in a shape of a U character to be fitted into the small-diameter step portion **93** of the top seat portion **90** is formed along the circumferential direction at an orientation matching the incline of the small-diameter step portion **93**. The depressed groove **61** is formed in a dimension which can surround three surfaces (an inner circumference surface, an upper surface and a lower surface) of the small-diameter step portion **93**. Therefore, in a status that the small-diameter step portion **93** has entered into the depressed groove **61**, the dust cover **50** is retained not to escape from the small-diameter step portion **93** in an axial direction (axial direction of the top seat portion **90**).

In the top connection portion **60**, an insertion circular-cylinder portion **65** is formed on the end side from the depressed groove **61**, and an incline circular-cylinder portion **66** is formed on the side of the bellows tube portion **51** from the depressed groove **61**. The insertion circular-cylinder portion **65** is formed in a shape of tapering off so that the circular-cylinder outer diameter at the end is smaller than the inner diameter of the small-diameter step portion **93** of the top seat portion **90**. The incline circular-cylinder portion **66**

is formed in a shape of a circular-cylinder tube which connects the upper end of the bellows tube portion **51** and the depressed groove **61** successively.

The dust cover **50** is fitted into the top seat portion **90** by pushing upward the insertion circular-cylinder portion **65** inside the top seat portion **90**. Since the cylindrical surface is formed in the shape of skirt spreading so that the diameter becomes larger toward a base side, the insertion circular-cylinder portion **65** elastically and smoothly deformed to the inner side in a radial direction and strides over the small-diameter step portion **93** in a process in which the dust cover **50** is pushed into the top seat portion **90**. And, once the insertion circular-cylinder portion **65** has stridden over the small-diameter step portion **93**, the small-diameter step portion **93** will enter into the depressed groove **61**, and the deformation of the dust cover **50** (deformation of the insertion circular-cylinder portion **65**) will be restored.

Thereby, the small-diameter step portion **93** is stored in the depressed groove **61**, and the upper end side of the dust cover **50** is fitted into the top seat portion **90**. The dust cover **50** is retained not to escape from the top seat portion **90** by this fitting (interdigitation). Therefore, a fitting portion for attaching the upper end side of the dust cover **50** to the top seat portion **90** is constituted by the depressed groove **61** and the small-diameter step portion **93**. In addition, the dust cover **50** is rotatable about an axis (around a rotation axis of the top seat portion **90**) with respect to the top seat portion **90**, in a case where a rotation prevention portion **100** which will be mentioned later is not formed.

In the bottom connection portion **70** of the dust cover **50**, an upper depressed portion **71** and a lower depressed portion **74** which are fitted with the protrusion **23** formed in the bump stopper cap **20** are formed. As the upper depressed portion **71**, a plurality of upper depressions **72** which are concave inward in a radial direction are formed at a predetermined interval along the circumferential direction. Moreover, the lower depressed portion **74** is formed under the upper depressed portion **71**. As the lower depressed portion **74**, a plurality of lower depressions **75** which are concave inward in a radial direction are formed so that they face the upper depressions **72**.

The upper depressions **72** are formed so that they are concave inward in a radial direction with a cross-section in a shape of a V character. The lower depressions **75** are formed so that they are concave inward in a radial direction with a cross-section in a shape of a U character.

The protrusion **23** formed in the bump stopper cap **20** has an incline protrusion surface **24** extending obliquely downward and radially outward from the circular-cylinder outer circumference surface **22** of the bump stopper cap **20**. The lower end surface **25** of the protrusion **23** is formed approximately in a horizontal direction.

If the bottom connection portion **70** of the dust cover **50** is seen from an inside viewpoint, a depression **76** (referred to as a middle depression **76**) which is concave outward in a radial direction will be formed between the upper depression **72** and the lower depression **75**. The dust cover **50** is attached to the bump stopper cap **20** by arranging the protrusion **23** of the bump stopper cap **20** in this middle depression **76**.

The dust cover **50** is fitted into the bump stopper cap **20** by being pushed downward, in a status that the bottom connection portion **70** is arranged so as to cover the upper end outer circumference of the bump stopper cap **20**. In this case, the lower depression **75** elastically deformed outward (pushed out) in a radial direction while smoothly sliding over the incline protrusion surface **24** of the protrusion **23** and strides over the protrusion **23** in a process in which the dust cover **50** is pushed downward. And, once the lower depression **75** has stridden over the protrusion **23**, the protrusion **23** will enter into the middle depression **76**, and the deformation of the dust cover **50** (deformation of the lower depression **75**) will be restored.

Thereby, the protrusion **23** is stored in the middle depression **76**, and the lower end side of the dust cover **50** is fitted into the bump stopper cap **20**. By this interdigitation (fitting), the dust cover **50** is retained rotatably about an axis with respect to the bump stopper cap **20**. Therefore, a fitting portion for attaching the lower end side of the dust cover **50** to the cylinder **11** of the shock absorber **10** (this is because the bump stopper cap **20** is fixed to the cylinder **11**) is constituted by the middle depression **76** and the protrusion **23**.

When the shock absorber **10** expands and contracts, the coil spring **30** also expands and contracts accordingly. When the coil spring **30** makes this expansion and contraction movement, the upper winding seat portion **31** and lower winding seat portion **32** make a repetitive rotational movement about a coil axis relatively. The upper winding seat portion **31** and the lower winding seat portion **32** of the coil spring **30** are respectively fixed to the top seat portion **90** and the bottom spring seat **18** through the insulators **85** and **19** repetitively so that they may not slide over these seats. Therefore, when the coil spring **30** makes an expansion and contraction movement, the top seat portion **90** is made to repetitively rotate about its own axis in connection therewith.

The upper end side of dust cover **50** is attached to the top seat portion **90** by the interdigitation along the circumferential direction, and the lower end side is attached to the bump stopper cap **20** by the interdigitation along the circumferential direction. For this reason, the upper end side of dust cover **50** can rotate about an axis with respect to the top seat portion **90**, and the lower end side can rotate about an axis with respect to the bump stopper cap **20**. In case of such a configuration, as mentioned above, whenever the top seat portion **90** is made to repetitively rotate about an axis according to the input from the top winding seat portion **31** of the coil spring **30**, the position of the dust cover **50** with respect to the top seat portion **90** shifts in one rotational direction or the other. Thereby, the load acting on the dust cover **50** becomes uneven along a circumferential direction, and a strain arises in the dust cover **50**. When the shock absorber **10** expands and contracts by a vertical vibration of the vehicle body **5** in this status, the dust cover **50** will be expanded and contracted in its strained status, and its endurance will fall.

Then, especially, as shown in FIG. **4**, the suspension device according to the present embodiment comprises a rotation prevention portion **100** so that the dust cover **50** cannot relatively rotate about an axis of the top seat portion **90** with respect to the top seat portion **90**. The rotation prevention portion **100** is constituted by two convex portions **110** formed on the top seat portion **90** and two concave portions **120** formed in the connection portion **60** of the dust cover **50**. In this embodiment, the convex portion **110** is a triangular prism-like object integrally erected downward (axial direction of the top seat portion) from the lower surface of the circular-cylinder wall **92** of the top seat portion **90**, and a lateral face which extends in a radial direction to an edge of the small-diameter step portion **93** is formed.

On the other hand, the concave portion **120** is a V character-like groove concave inward in a radial direction in

a shape of a V character, which has been formed parallel to the axial direction of the top seat portion **90** with a position and size for enabling to be fitted with the convex portion **110** on the lateral face of the connection portion **60** in the dust cover **50**. Therefore, groove surfaces **121**, **122** which face the lateral faces **111**, **112** formed in the convex portion **110** are formed in the concave portion **120**. In addition, back-sides of the groove surfaces **121**, **122** are shown in FIG. **1**. The convex portion **110** is equivalent to the seat side rotation prevention portion according to the present invention, and the lateral faces **111**, **112** are equivalent to the seat side rotation prevention surfaces according to the present invention. Moreover, the concave portion **120** is equivalent to the cover side rotation prevention portion according to the present invention, and the groove surfaces **121**, **122** are equivalent to the cover side rotation prevention surfaces according to the present invention.

The dust cover **50** is attached to the top seat portion **90** by pushing upward the insertion circular-cylinder portion **65** inside the top seat portion **90**, in a status that the concave portion **120** and the convex portion **110** of the top seat portion **90** are aligned. At this time, while the small-diameter step portion **93** enters into the depressed groove **61** of the dust cover **50** and thereby the dust cover **50** is retained not to escape from the top seat portion **90**, the convex portion **110** of the top seat portion **90** is inserted into the concave portion **120** of the dust cover **50** and the lateral faces **111**, **112** of the convex portion **110** and the groove surfaces **121**, **122** of the concave portion **120** mutually face around the axis of the top seat portion **90**.

Thereby, even if the dust cover **50** tends to rotate about an axis with respect to the top seat portion **90**, the lateral faces **111**, **112** of the convex portion **110** contact with the groove surfaces **121**, **122** of the concave portion **120** and thereby a rotation about an axis is prevented. Therefore, the top connection portion **60** in the dust cover **50** is fitted non-rotatably about the axis with respect to the top seat portion **90**. In addition, the lateral faces **111**, **112** formed in the convex portion **110** and the groove surfaces **121**, **122** formed in the concave portion **120** may be configured to always contact mutually, or they may be configured to come to contact mutually when the dust cover **50** rotates slightly about an axis with respect to the top seat portion **90** and thereby prevent a further rotation.

In accordance with the suspension device for a vehicle according to the present embodiment explained above, the dust cover **50** can be easily attached and the dust cover **50** can be prevented from rotating about an axis with respect to the top seat portion **90**, by pushing the both ends of the dust cover **50** into the top seat portion **90** and the bump stopper cap **20** (sheath side member). For this reason, even if the top seat portion **90** rotates about an axis by the expansion and contraction of the shock absorber **10**, the position of the dust cover **50** with respect to the top seat portion **90** does not shift from its initial position. Therefore, since the dust cover **50** can be always maintained in a proper position, a trouble such as the expansion and contraction of the dust cover **50** in a status that the dust cover **50** is distorted can be prevented. As a result, the endurance of the dust cover **50** can be improved.

As mentioned above, although the embodiment according to the suspension device for a vehicle of the present invention has been described, the present invention is not limited to the above-mentioned embodiment, and various modifications are possible unless they deviate from the objective of the present invention.

For example, although the configuration wherein the lower end of the dust cover **50** is connected with the bump stopper cap **20** is adopted in the present embodiment, it is not necessarily to be connected with the bump stopper cap **20**. A configuration wherein a fitting piece (not shown) is disposed in the bottom spring seat **18** or the circular-cylinder outer circumference surface of the cylinder **11** and the lower end of the dust cover **50** is rotatably fitted with this fitting piece can also be adopted.

Moreover, although the convex portion **110** formed in the top seat portion **90** and the concave portion **120** formed in the dust cover **50** constitute the rotation prevention portion **100** in the present embodiment, alternatively, for instance, the rotation prevention portion may be constituted by forming a concave portion in the top seat portion **90** and forming a convex portion in the dust cover **50**, etc. Moreover, the numbers, shapes, position and so on of a convex portion and a concave portion can be set arbitrarily.

REFERENCE SIGNS LIST

10: shock absorber, **11**: cylinder, **12**: piston rod, **14**: bound stopper, **18**: bottom spring seat, **19**: insulator, **20**: bump stopper cap, **23**: protrusion, **30**: coil spring, **31**: upper winding seat portion, **32**: lower winding seat portion, **50**: dust cover, **51**: bellows tube portion, **60**: top connection portion, **61**: depressed groove, **65**: insertion circular cylinder, **66**: incline circular-cylinder portion, **70**: bottom connection portion, **71**: upper depressed portion, **72**: upper depression, **75**: lower depression, **74**: lower depressed portion, **76**: middle depression, **80**: top spring seat unit, **81**: base portion, **85**: insulator, **85**: strut bearing, **90**: top seat portion, **91**: ring-like plane surface, **92**: circular-cylinder wall, **93**: small-diameter step portion, **100**: rotation prevention portion, **110**: convex portion, **111**, **112**: lateral face, **120**: concave portion, **121**, **122**: groove surface, Lab: axis.

What is claimed is:

1. A suspension device for a vehicle comprising:

a shock absorber disposed between a wheel and a vehicle body,

a coil spring disposed between a top spring seat in a shape of a ring and a bottom spring seat in a shape of a ring, said top spring seat is disposed on the side of a structure which supports said vehicle body and said bottom spring seat is disposed on a cylinder sheath side of said shock absorber, and

a dust cover disposed between said shock absorber and said coil spring, said dust cover is elastically deformable and is in a shape of bellows tube,

wherein:

said top spring seat is formed so that a supporting surface which supports an upper end of said coil spring through an insulator is inclined to an axis of said shock absorber and said top spring seat is disposed rotatably about a top seat axis inclined to said axis of said shock absorber,

a lower end of said dust cover is attached to a sheath side member rotatably about an axis of said shock absorber, by being fitted into said sheath side member fixed and disposed on said cylinder sheath side,

an upper end of said dust cover is attached to said top spring seat by being fitted into a radially inner circumference portion of said top spring seat and comprises a cover side rotation prevention portion forming cover side rotation prevention surfaces which are surfaces enable to contact with said top spring seat in both rotational directions about said top seat axis so that said upper end of said dust cover does not relatively rotate

about said top seat axis over said top spring seat in a status that said upper end of said dust cover is fitted into said radially inner circumference portion of said top spring seat, and

said top spring seat comprises a seat side rotation prevention portion forming seat side rotation prevention surfaces which are surfaces enable to contact with said cover side rotation prevention surfaces.

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